

Free and Open Source Software for Geospatial (FOSS4G) Conference Proceedings

Volume 17 Boston, USA

Article 25

2017

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Recommended Citation

Asanuma, Ichio; Yamaguchi, Takashi; Park, Jong-geol; and Mackin, Keneth J. (2017) "Optimum Object Analysis Of Islands Activities On South China Sea By DNB On VIIRS," *Free and Open Source Software for Geospatial (FOSS4G) Conference Proceedings*: Vol. 17 , Article 25.

DOI: <https://doi.org/10.7275/R5CN724S>

Available at: <https://scholarworks.umass.edu/foss4g/vol17/iss1/25>

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Optimum Object Analysis Of Islands Activities On South China Sea By DNB On VIIRS

Optional Cover Page Acknowledgements

This research is partly supported by the Office of Naval Research Global of the USA with the grant number of N62909-15-1-2074.

Optimum Object Analysis Of Islands Activities On South China Sea By DNB On VIIRS

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Abstract: A data processing and analyzing system was designed and made operational with free software to process the big data over the South China Sea (SCS), which are provided by the Visible Infrared Imaging Radiometer Suite (VIIRS) on the Suomi National Polar-orbiting Partnership (Suomi-NPP) to monitor the light distributions in the night. The VIIRS data are processed from the raw data (level-0) to geophysical data (level-3) using the International Polar Orbiter Processing Package (IPOPP), which are freely available from NASA. The Day Night Band (DNB) of VIIRS is extracted from the level-3 data and is geospatially projected for our region of interest (ROI) on the SCS. For those ingested data, an optimum object analysis in geographic domain was proposed to estimate the reclamation activities on coral reefs in the SCS using GDAL. A pixel base analysis of DNB data is possible to estimate the island activities independently among dredgers, support vessels, or buildings on coral reefs, but not appropriate to analyze the activities for as an integrated system or for the changes in the ROI. Although there is a difficulty to determine the scale of objects on the analysis of DNB data for the reclamation activities, the optimum object scale was empirically determined for different size of coral reefs and was applied for this study. The optimum object analysis determines the reclamation activities with including lights not only from buildings but also dredgers and supporting vessels around coral reefs.

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Optimum Object Analysis Of Islands Activities On South China Sea By Day Night Band (DNB) On Visible Infrared Imaging Radiometer Suite (VIIRS)

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Objectives

Objectives of this study are to detect the island activities and to monitor a change of fishing activities on the Spratly Islands in the South China Sea, Using the Day Night Band (DNB) [1,2] of the Visible Infrared Imaging Radiometer Suite (VIIRS) on the Suomi National Polar-orbiting Partnership (Suomi-NPP).

Region Of Interest (ROI)

The Spratly Islands are one disputed area in the world among nations faced into the South China Sea. Recently, China reclaimed several coral reefs, which escalated the conflicts among them.

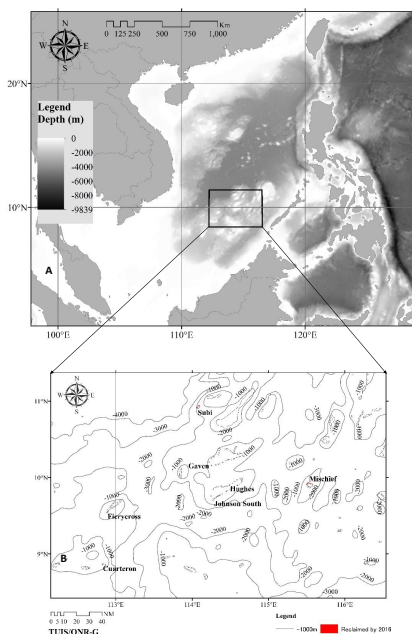


Fig.1 Region of interest (ROI) of Spratly Islands in the South China Sea, 7 reefs were reclaimed by China.

Fig.4 History of mean lights from the optimum size of buffer.

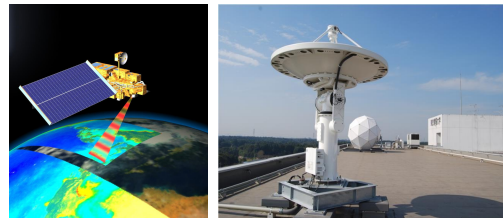


Fig.2 Tokyo University of Information Sciences (TUIS) operates three receiving stations in Japan. The station on the Miyakojima Island covers the Northern half of South China Sea.

Method

Raw data to level-2 data

International Polar Orbiter Processing Package (IPOPP), FOSS provided by NASA, ingests the raw data of VIIRS, received by the ground stations, and process to level-2 (geophysical data) through level-0 and -1 [3].

Level-2 to level-3 data

The DNB, 500 to 900 nm, and M12, 3.66 to 3.84 μm , are extracted from 22 multiple bands to identify lights from surface, and geospatially projected on to the map over the ROI using **Geospatial Data Abstraction Library (GDAL)**.

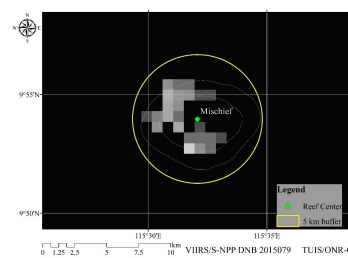


Fig.3 Lights distribution detected by DNB over Mischief Island with a buffer of 5 km radius from the center of island, observed on March 19, 2016.

The lights from the surface without the lunar illumination could be easily identified by DNB, but the lunar illumination makes it difficult when lights reflected by clouds exist.

Change of mean intensity within buffer

The mean intensity within the buffer was obtained by **QGIS** for the reclaimed islands by the Chinese government from Jan. 1st of 2014 to Dec. 31st, 2016. The buffer is defined to include lights on the islands and vessels around the island as an optimum size of buffer based on objects.

Results

A slightly increase in DNB mean intensity was observed at the beginning of dredging at Subi Reef and Mischief Reef. Similarly, a sharp reduction in DNB mean intensity was observed at the end of dredging at Subi Reef and Mischief Reef, but was that drop in intensity was not as clear at Fiery Cross Reef. It is estimated that the dredging period at Subi and Mischief Reefs were about 6 months each.

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Acknowledgement

This research is partly supported by the Office of Naval Research Global of the USA with the grant number of N62909-15-1-2074.